HANDY REPAIR HINTS *for* FARM USE

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By **FRANKLIN S. CLARK**

WITH ACKNOWLEDGMENTS TO THE NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY FOR MUCH OF THE FACTUAL AND ILLUSTRATIVE MATERIAL.

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM STEEL BETHLEHEM, PA.

WITH OUR COMPLIMENTS

IN SPONSORING this booklet on handy repair hints, Bethlehem Steel Company is following its policy of trying to give maximum service to the customer. The products which we sell must be useful and profitable to the buyer, if he is going to continue to trade with us.

It is our aim to make the best possible products and to sell them through jobbers and dealers who have a reputation for square dealing.

Bethlehem is in an exceptionally fortunate position to serve agricultural America. The original Bethlehem Iron Company was located in the midst of a farming community, and had varied experience in making steel for plows, pitchforks, kettles, and other metal material used in farm economy.

The first iron to be tapped from our furnaces was in 1863. The pioneering steps in the making of alloy steels were developed at our Bethlehem, Pa. mill in the 1890's.

We guard zealously our reputation for honest manufacturing, built up during seventy years of steel making. When you need wire fencing you can feel safe in buying our Bethanized Fence. When you require woven wire fence, fence posts, steel roofing and other galvanized sheets, barbed wire, nails, bolts and nuts, and any form of steel material, Bethlehem's long experience is ready to serve you.

BETHLEHEM STEEL COMPANY

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WITH the help of the modern machinery and equipment now at his disposal it has been computed by the U. S. Department of Agriculture that one farm laborer can get as much work done today as seventy tillers of the soil in Biblical times. So even on a one-man place the farmer today has in effect seventy men working for him. He's more than just a farmer; he's an employer. If he happens to have a hired man or two working for him he is in fact a large employer.

THE MONEY UNDER THE TRACTOR

IN one sense this age of specialization hasn't touched the farmer. Thus while a few years ago the tendency was in the direction of making a big gamble on a single crop, now the trend is toward diversification. But even the farmer who specializes in one or a few crops or products must today himself be something more than a specialist. Indeed he's practically got to be a whole collection of specialists. "Know it all," as you might say. And he's got to have the kind of "know it" that means being able to do it.

This is because the farm of today has so many different kinds of equipment and machinery on it. And because that important matter of getting the work done on a farm depends so directly upon keeping all this equipment in repair and working order. A competent farmer today has practically got to be a fair mechanic. Otherwise his repair bills alone may be his ruination. If he is something of a blacksmith it may be an asset worth many dollars each year. He ought to be a fair carpenter, know how to lay a roof; and how to really put up—not just throw up—a fence. It will all be to the good, too, if he knows a thing or two about the use of a soldering iron and how to do a simple pipe fitting job.

Think it over. The successful farmers in almost any community can be known by their absence on rainy days from the court house steps. Are they so smart that rain doesn't bother them in haying or harvesting; or so tough that they don't mind it in plowing? Nonsense! Usually, if you call around at the place of one of the absentees his wife will tell you, "He's out there tinkering around somewhere."

And that's where you do find him. Maybe he's on his back under the tractor in the tool shed. Broke down? No. And it won't. Because he's fixing the gadget that

might otherwise have caused the trouble. Or you may find him at his tinkering in the farm shop. "Yes, sir," he'll tell you. "There's always something to do around a place like this."

And that's true. It's true about any farm today. Go into the engine room of a great ocean liner while it is idling in port, and you'll hear the industrious tappings of mechanics at work, with cold chisels, wrenches, sledges. A modern farm is in the same category. Slack seasons and rainy weather provide the opportunities to keep things ship-shape and in working order.

That's where the money is for a farmer on a rainy day—out in the tool shed under the tractor. It isn't on the court house steps. This little booklet on "Handy Repair Hints For Farm Use" is dedicated to the farmers on farms where "there's always something to do." Yes, and money to be made doing it. For repairs attended to betimes are a saving—looked at any way. Often enough a half-hour of tinkering saves a half-day of cussing.

PHOTO N.Y.S.C.A.

At Work in the Shop

THE FARM SHOP

NO farm is too small to have its shop. Here tools, machinery or implements may be conditioned or repaired to add golden hours to the all too short days of ploughing, planting and harvesting.

The other buildings on the farm serve as places for keeping livestock, produce or implements. The shop is the storage place for that most valuable of intangibles in farm management, the "ounce of prevention." It's a place where by forethought time is stored. That is to say, it can and ought to be all of these things. But in practice, unfortunately, it often falls far short of them. And rather than being a sort of temple dedicated to forethought it is the hiding out place of afterthought; the place on the farm kept in the worst muddle. Instead of being a place where time is stored it becomes a catch-all for junk and rubbish.

A farmer at work in his shop should be able to put his hand on the tool, the nail, the bolt or nut that he needs as expeditiously as an operating surgeon reaches for his instruments. Such orderliness in the shop makes it possible to effect a repair on the double-quick when some implement or piece of machinery has broken down on the job. Such orderliness also promotes quality of workmanship. And, furthermore, it eliminates once and for all the frantic and oft ludicrous searchings in which some farmers endlessly waste time every now and again looking for some needed article or tool that has been mislaid.

The size and elaborateness of equipment of the farm shop is a matter partly to be governed by the amount of money that a farmer has to put into it. But every farm has its minimum requirements, and to stint beyond them is false economy. There are few farms on which a serviceable work bench does not come well within the minimum requirement of repair equipment. The work bench should be constructed of 2-inch planking. Mounted at one end of it should be a heavy iron vise, preferably of the type known as a blacksmith's vise. The other end of the bench may be equipped with a wood-working vise which is especially convenient in planing down the edges of boards.

The shop itself either may be a partitioned-off place in some other building like the garage or tool shed, or it may be a separate building.

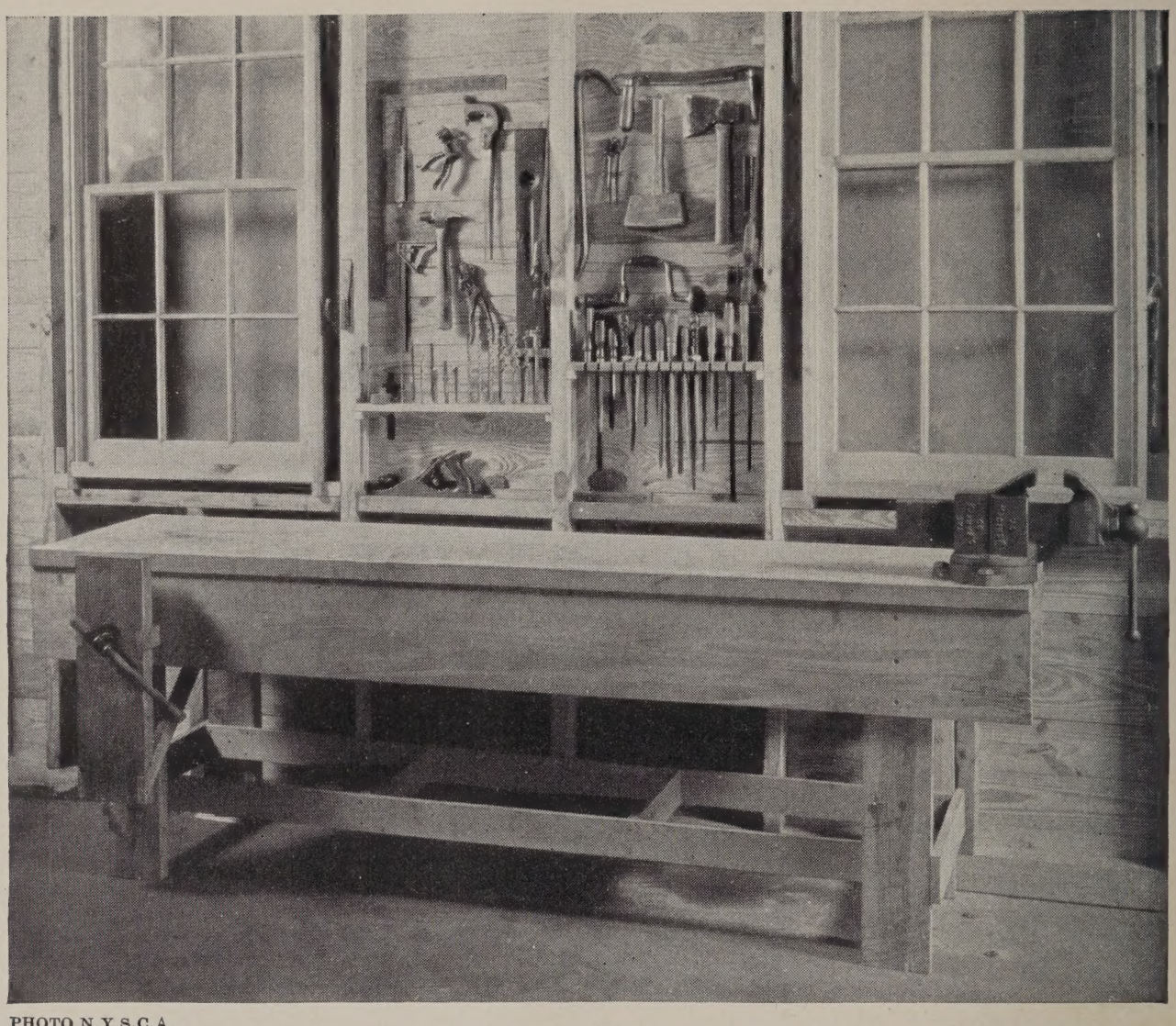


PHOTO N.Y.S.C.A.

Bench and Tool Racks

Usually it is most convenient to have it included in another building. If feasible a storage attic above it will come in handy for lumber and other supplies. It should be convenient to the other farm buildings in any case. If it can be included as a part of the tool shed it will have the advantage of always being convenient to the farm implements, the main source of repair jobs. It should have a stove in it so that it can be heated in cold weather. This will make it comfortable to work in during the winter months when the let-up of farm work provides the best opportunity for the general overhauling of equipment.

DIMENSIONS AND ARRANGEMENT

Dimensions of 18 by 20 feet are not too large for the shop on an average-size farm. A 9-foot doorway served with double doors on a roller track will make it possible to roll in pieces of farm machinery on which extensive repair jobs are required. And a shop of 20-foot length makes it possible to close the doors when such machinery is inside it. The bench should be up against the wall, running lengthwise of the shop

PHOTO N.Y.S.C.A.

A Handy Nail Kit

and 2 feet or more wide. The extra floor space does not need to be wasted when not in use for a repair job. It may serve at other times as a garage or storage space for some farm tool. There should be at least two windows on the side at which the bench is placed. If the shop is in the same building as the tool house it will be convenient to have a small door opening through the partition into the tool shed. The shop will be easier to heat if it is built warmly. If two layers of sheathing with a layer of building paper between them are employed on the outside of the studding the space between the exposed studs on the inside of the shop may be used to advantage in providing places to keep tools.

HOW TO KEEP TOOLS IN PLACE

The illustration shows how such a space may be used to accommodate an assortment of tools. Most of the tools can be hung from nails driven into the wall or from screw eyes. Provision may be made for tools, like planes, that cannot be conveniently hung up by inserting shelves between the studs.

As has been intimated the soul of the shop is orderliness. Every tool should have its place; and be returned to that place as soon as its user is through with it. If a silhouette or likeness of each tool is painted at the place on the wall where the tool belongs it will be found to be an invaluable help in the enforcement of this rule. The silhouettes can easily be made by placing the tool in its proper place, marking around it, and then filling in between the pencil lines with black paint. A small brush should be employed and care exercised to do the job neatly. It may be an excellent plan to keep certain of the tools or all of them at times locked up. If this seems advisable the space between the studs may be converted into cupboards by hanging doors on them, and these equipped with locks.

Tools which have similar uses should be grouped together so far as possible. The tools that are most commonly used should be grouped within easy reach of the iron vise, the main center of activity. Among such tools would be

the more common iron and wood working tools, such as hammers, saws, braces, bits, drills, cold chisels and wrenches. The more common iron working tools should be grouped in one compartment, the more common wood working tools in another. And the bits, braces and drills may be grouped together since the drills are as suitable for use with wood as they are with metal. A rack for the bits may be made by boring holes in a wooden strip, preferably of hard wood, squaring them out with a chisel to fit the shanks, then nailing it on the wall. Similarly, a rack for round-shanked twist drills can be made by boring a hole for each drill part of the way through such a strip. Then near these compartments for the common tools the space between two or more studs may be devoted to bins for the various sizes and types of nails, nuts, bolts, washers, rivets and screws that are in common use on a farm. Harness mending tools should also be within easy reach of the working area around the vise. Off at one side or on lower shelves between the studding the tools that are used only on special occasions may be grouped, such as soldering-coppers, the blow torch, fence-building and roofing tools, and painting supplies.

Depending on a farmer's mechanical inclination or the accessibility of a blacksmith shop a small forge is optional equipment, and the anvil and other tools that go with it. On large farms facilities for ordinary blacksmithing jobs may be classed as essential equipment however. The forge and anvil belong in the shop also. In the corner furthest from the door on the same side as the bench is a good location for them. On a large farm, too, a small drill press is economical equipment. If desired a small motor or gasoline engine may be employed to operate the forge bellows, the drill press and perhaps also a power grinder.

FARM SHOP EQUIPMENT

The following is a list of tools recommended for farm shop equipment by the farm extension service of the New York State College of Agriculture at Cornell University:

FARM CARPENTRY TOOLS

1—claw hammer.
1—24-inch, 8-point, cross-cut handsaw.
1—24-inch steel square.
1—26-inch hand ripsaw.
1—14-inch iron jackplane.
1—ratchet brace, 10-inch sweep.
1—set of 8 auger bits: 1/4-inch, 5/16-inch, 3/8-inch, 7/16-inch, 5/8-inch, 3/4-inch, 1-inch.
1—expansive bit, 7/8-inch to 3-inch.
1—combination mitre and try square, 12-inch.
1—rose countersink.
1—nail set.
1—screwdriver bit.
1—4-inch screwdriver.
1—10-inch screwdriver.
1—1/4-inch chisel.
1—1/2-inch chisel
1—1-inch chisel.
1—6-inch slim-taper triangular file.
1—8-inch regular-taper triangular file.
1—10-inch rat-tail file.
1—10-inch flat mill file.
1—10-inch flat bastard file.
1—10-inch half-round bastard file.
1—12-inch half-round wood rasp.
1—woodworkers' vise.
1—auger-bit file.
1—marking gauge.
1—26-inch spirit level.
1—4-1/2-inch broad hatchet.
1—8-inch steel wing dividers.
1—10-inch T bevel.
1—24-inch wrecking bar.
1—2-3/4-pound wooden mallet.
1—interchangeable file handle.
1—2-inch x 8-inch combination carborundum oilstone.
1—12-inch compass saw.
1—10-inch drawshave.
1—handsaw set.
1—timber-saw set.
1—cross-cut saw tool.

FARM METALWORKING TOOLS

1—blacksmith's solid box vise, 4-1/2-inch jaw.
1—hack-saw frame, with 12 blades.
1—2-pound machinist's hammer.
1—3-1/2-pound blacksmith's hand hammer.
1—8-inch monkey wrench.
1—21-inch monkey wrench.
1—8-inch adjustable S wrench.
2—14-inch pipe wrenches.
1—chain drill.
1—1/4-inch bit-stock drill.
1—5/16-inch bit-stock drill.
1—11/32-inch bit-stock drill.
1—3/8-inch bit-stock drill.
1—13/32-inch bit-stock drill.
1—7/16-inch bit-stock drill.
1—1/2-inch bit-stock drill.
1—5/8-inch bit-stock drill.
1—hand drill.
1—set of 9 twist drills: 1/16-inch, 5/64-inch, 3/32-inch, 7/64-inch, 1/8-inch, 9/64-inch, 5/32-inch, 11/64-inch, 3/16-inch.
1—6-inch carpenter's pinchers.
1—6-inch slip-joint pliers.
1—cold chisel, 1/2-inch.
1—cold chisel, 5/8-inch.
1—cold chisel, 3/4-inch.
1—hand punch, 1/4-inch.
1—hand punch, 3/8-inch.
1—hand punch, 1/2-inch.
1—rivet set.
1—whetstone.
1—taper-point soldering iron, 2-pounds.
1—wooden handle for soldering iron.
1—1-pound wire solder.
1—box soldering paste.
1—tinner's snips.
1—12-ounce riveting hammer.
1—center punch.
1—screw plate (stocks and dies): 1/4-20, 5/16-18, 3/8-16, 7/16-14, 1/2-13.
1—quart blow torch.
1—footpower emery grinder.

HARNESS REPAIRING

1—4-tube spring punch.
1—trimming knife.
1—awl haft, and 4 assorted blades.
1—finishing wheel.
1—Rex riveting machine.
2—punches, 3/32-inch, 4/32-inch.
1—ball No. 10 white linen thread.
1—box assorted tubular rivets.
1—box assorted copper rivets.
1—paper of sewing needles, assorted.
4—balls harness-makers' wax.
1—piece beeswax.

FENCES

Keep Fences Clear of Weeds

ALL-PURPOSE woven type of fence with all line wires of good heavy No. 9 wire is the most satisfactory to fence the whole farm where a plan of diversified farming is followed. Then it is possible to turn animals from one field to another without going to extra trouble at seasons when time is at a premium. A fence at least 50 inches high is advisable to turn all farm animals. Where horses are included in the stock pastured, a strand of barbed wire should be stretched along the top of the woven wire about 4 inches above it and on the inside of the posts. This will prevent the horses from attempting to reach over it and so loosening it. Similarly a strand of hog-type wire with the barbs 3 inches apart run along about an inch from the ground at the bottom will prevent hogs from rooting under the fence. But this may not be necessary if a heavy fence is used that is close to the ground at all places.

The fence problem varies on each farm. Thus where cattle alone are pastured it may be justifiable economy to employ barbed wire for the fences away from the road. And an economy fence that will turn all kinds of stock can be constructed of 40-inch woven wire with not less than 9 line wires by topping it with two strands of barbed wire. The first strand of barbed wire should be stretched 4 inches above the top of the woven wire, and the second 6 inches above that. Hog-type wire with barbs 3 inches apart is best for this purpose.

Yet regardless of the type of farming followed it is a protection and good advertising to have an up-to-date woven type of fence on all land facing public highways, with their constant stream of motorists these days. If the fence is hung on steel fence posts that will add just so much to its smart appearance. Keep the weeds and brush mowed down along every fence. For that is good advertising, too; and, incidentally, this practice appreciably increases the life of a fence. For where weeds are kept down stock is not enticed to be forever reaching for some luscious morsel just out of reach on the other side. And fences do not rust as rapidly if they are kept free and clear of vegetation.

Inspect all fences on the farm each spring to observe if any of the posts have been heaved by the frost. It is best to examine them also every month or two while stock are in pasture. The United States Department of Agriculture is authority for the statement that no more than 50% of the fences on American farms are properly erected, or properly cared for after they are erected. The art of keeping modern fences in repair is like the practice of medicine at its best, largely preventive. The one way to get the longest life out of a fence is to keep it tight. If stock have crowded against a fence or if for any reason it has become slack it is dollars and cents in the farmer's pocket to get after it right away and tighten it up. Restretching it may suffice. But if it has become badly stretched out of shape the best plan is to take it down, reset any posts that are out of line and practically rebuild it.

HOW TO PUT UP A FENCE

The tools required for erecting a woven type of fence include a woven wire fence stretcher, single stretcher cutter pliers, wire splicer, hammer or hatchet to drive staples or fasten the line wires to the posts. A sharp hatchet is the most convenient if wooden posts are used as it can be employed to hew off posts that are out of line. A wooden maul or special post driver is required for driving steel posts.

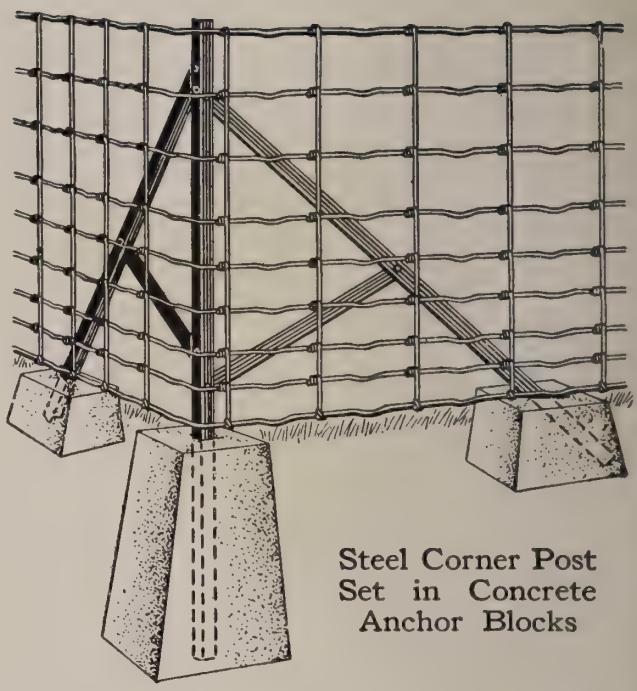
No fence is better than its posts. So the posts are the first consideration in erecting a fence. Steel posts are the most attractive appearing and the easiest to erect, as it is only necessary to drive in the line posts. The U. S. Department of Agriculture has computed that two men working under ideal conditions can put up 500 steel posts in a day. In long straightaway stretches of fencing many farmers who use steel posts make a practice of anchoring a post every 40 rods in concrete. This is a safeguard against the stock pushing the posts out of line. The end posts and corner posts, if they are of steel or of whatever type, should always be anchored.

Special Steel Post Driver

THE CORNER POSTS

If the soil is fairly firm the hole for receiving the concrete anchor block for a steel end or corner post should be 18 to 20 inches square and at least 3 feet deep. The bottom dimensions should be several inches wider. When concrete is poured into this hole to form an anchor block the wider dimensions at the bottom give it a pyramid-

like shape that prevents heaving. In pouring the concrete fill the hole even with the ground, banking it up at the top slightly so that it will shed water. Insert the post in the middle, being careful to get it plumb. Be careful also to get the post set at just the right depth so that its top will be about 2 inches above the wire. Either have a measuring stick to gauge the height of the post or measure the post itself, before setting it, against the width of the fencing, making a mark on it that can be brought even with the surface of the cement.



Steel Corner Post Set in Concrete Anchor Blocks

The hole for the block in which the brace is anchored should be about the same dimensions as that of the post itself, and also of wider dimensions at the bottom. In most soils a depth of 16 to 18 inches will be deep enough for the brace block.

It is a good plan to stretch a line as a guide in setting the line posts. One or two posts out of alignment will spoil the appearance of the whole fence and interfere greatly with its efficiency. In driving the line posts it is better to use rather light blows rather than trying to pound them in as far as possible at each blow. The line posts in hollow places should be anchored in cement.

If wooden posts are employed the end or corner posts should not be less than 8 inches in diameter at the butt and 3½ to 4½ feet in the ground. Wooden corner and end posts may be anchored by spiking cleats of two-inch planking to them. The cleats should be about 24 inches long and 6 inches wide and fastened to the post with 6-inch spikes. One of the cleats should be spiked to the bottom of the post and the other at a point near the surface and at right-angles to the line of the fence. Corner posts should be equipped with three such anchors—the two at right-angles to each other at the top. Tamp the soil firmly. Wedge in some sizeable rocks if they are available. Line posts for hollow

Method of Bracing Wooden Corner Post

Method of Anchoring Wooden Corner Post

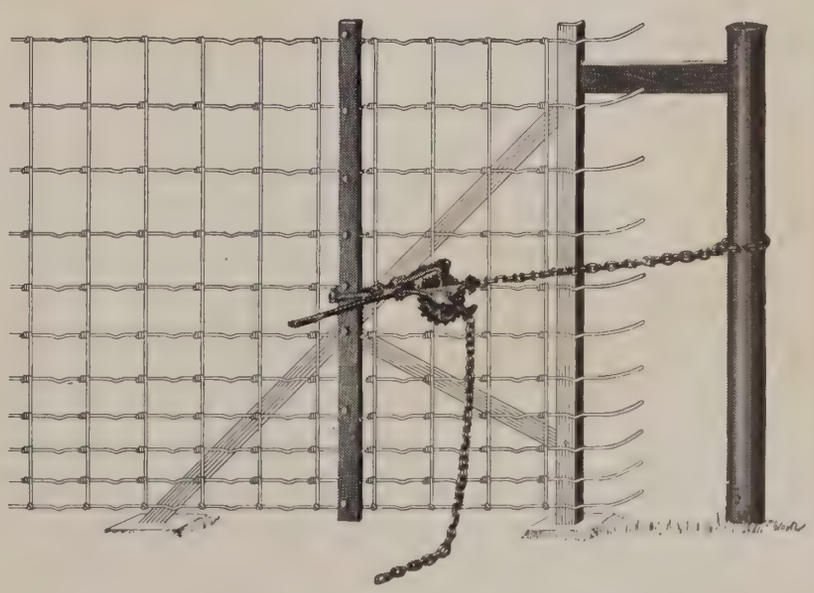
places should be equipped with a single anchor at the bottom. After the posts are set, sight down them to see that they are in line. If they are wooden posts it may be necessary to hew off bulges or knots that throw some of the posts out of alignment.

STRETCHING THE FENCE

Unroll the fence on the ground with the bottom near the post. Fasten the end to the post at which operations are started by wrapping the line wires around it and neatly splicing each one to itself. Go to the other end-post and pull as much as possible of the slack out of the fence while it is lying on the ground. Then attach the stretcher bar. With most types of stretchers it will be necessary to erect a dummy post four or five feet back of the end-post to provide a purchase hold as shown in the illustration below. This may be braced against the end-post with a piece of planking. About 40 rods of fencing is enough to stretch at one time with a stretcher. If a tractor is used rather than a stretcher 80 rods may be stretched at one time.

After the fence is stretched, the best practice is to use the single-wire stretcher to properly fasten it, as it is possible to attach the clamp of the single wire stretcher on one line wire at a time in a position very close to the permanent end or corner post. Cut away a sufficient number of line wires to allow ample tying lengths. Now, with the single-wire stretcher, and before removing the woven-fence stretcher, stretch each line wire commencing at the top snugly up to the permanent post. Wrap the loose end of the wire all the way around and securely tie it back on itself at the inside center of the post. When the bottom wire has been reached and securely fastened in this manner the woven fence stretcher bar may be removed. Never attempt to stretch a fence around a corner. It is much simpler and more satisfactory practice to cut the fence and commence over again at each corner.

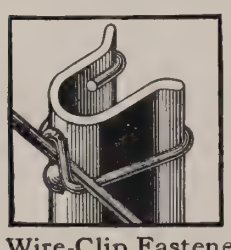
When steel posts are used the wires are fastened to the line posts by various methods, according to the type of post employed. Some of the posts are equipped with "self-fastener" steel lugs that may be bent lightly over the wires with a tap of the hammer, others are designed so that steel fence post staples may be employed, and some employ special wire clips



Woven Wire Fence Stretcher and Dummy Post

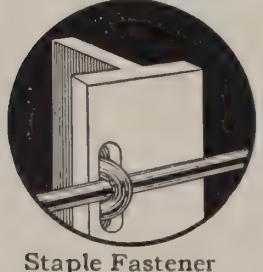
that come with the posts. When wooden posts are used care should be exercised not to drive the staples so far in as to bind the wire down. If the staples are not driven too tight the strain is distributed more evenly when stock crowd against the fence, or when changes of temperature cause expansion and contraction.

One of the rules for tightness is to stretch a fence until a man can stand on the lateral wires without pulling them down more than a few inches. As long as the kinks are not pulled out of the line wires there is little danger of stretching fence too tightly. Fence that runs over level ground may be stretched more tightly than it can be over rolling or hilly land. If the fence runs over a hill it may be best to cut the fence at the top of the hill and start over again, and, so similarly, at the bottom of the hill. Level off every unevenness of land in the line of the fence as far as possible.



Wire-Clip Fastener

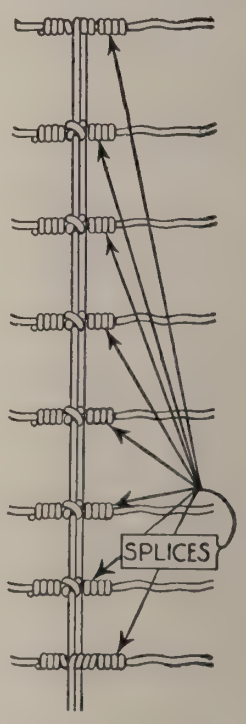
Lug Self-Fastener



Staple Fastener

Types of Steel Fence Posts Fasteners

If it is necessary to splice fence do not loop the ends together, as this method besides making an untidy appearance usually results in long and short wires that cause difficulty in stretching. The proper way is to lay the fence flat on the ground, drawing the two ends together until the last stays on each piece are tight together. Then tightly twist the overlapping line wires each side of the stays as shown in the illustration.



Method of Splicing Woven Fence

ROOFS

A POORLY roofed set of farm buildings is like a coat out at the elbows. One patch but invites another. And every now and then a leak occurs that through pressure of work or other cause is for a time neglected and then damage results to the buildings themselves or to their contents. Every farmer owes it to himself and to his pocketbook to have his buildings well roofed. A roof that protects only against the weather is better than none. But to farmers, who as a class are obliged to pay higher insurance rates than apply on town or city property, a roof that protects against fire as well as weather doubly recommends itself. When it is considered that a steel roof which provides this two-fold protection is also one of the most economical roofs it becomes quite evident that this is the ideal roofing material for farm use.

Galvanized steel roofing comes in three standard types and Bethlehem Stormproof Roofing is a fourth and newer type of a side lap construction that checks capillary attraction as well as affording great rigidity. Stormproof Roofing and also corrugated and V-crimped roofing come in standard lengths of from 5 to 12 feet. Roll roofing comes in 50-foot rolls and is the preferable type for roofs having a pitch of less than 2 inches to the foot. Roll roofing, Stormproof or V-crimped, are suitable for the farm house as well as the outbuildings and barn, and these latter two types are adapted for use as sheathing as well as roofing. V-crimped comes in 2, 3 and 5 crimps. Corrugated roofing which is often the most economical

A Set of Farm Buildings Roofed with V-Crimped Galvanized Steel Roofing

for barns and outbuildings is made with 1¼-inch, 2-inch and 3-inch corrugations.

With a few simple tools a farmer may apply any of these roofs himself by following out directions that will be supplied by the dealer from whom the roofing is secured. Or at no great expense he may hire the work done by an experienced roofing contractor.

USE AND CARE OF ROOFS

Roofs are a part of a farmer's working equipment. Just as other equipment may be abused by improper use or neglect so also can a roof be abused.

The roof deck of buildings in which animals are housed should be made of tight matched sheathing or ship-lap. If the sheathing is not tight it should be covered with a protective layer of asbestos felt or other material before the steel roofing is applied. For if this precaution is not taken or the deck is not tight the moisture given off by the animals will condense on the under side of the roofing and rust it.

If buildings are not used to house animals, however, a saving in construction costs can be effected by laying the corrugated type of roofing on rough-edged or slat-type sheathing with spaces of several inches between the boards. Indeed, if a good heavy weight of corrugated roofing is employed, of, say, not less than 22 or 24 gauge, the supports for it may be several feet apart. Heavier timbers, called purlins, rather than sheathing are usually employed in this type of construction. These purlins can be set as far as 4½ feet apart, but always the ends of the roofing sheets should be supported by timbers directly beneath them. Roofing with 2½-inch corrugations is preferable for this type of construction. Similarly, these corrugated sheets may be substituted in place of wooden sheathing on the sides of certain types of farm buildings. This type of construction has long been economically employed for industrial use.

Inspect Roofs Once a Year

Corrugated roofing can be laid on the top of old shingles provided they present a fairly even surface. Generally speaking, however, the slight extra expense of removing the old roofing is amply made up for by the better job that results from removing it, and so supplying a firm and even surface for the new roofing.

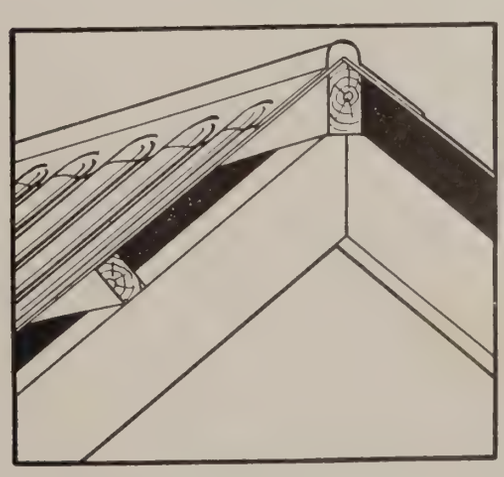
Galvanized Corrugated Roofing on Bull Pen—Holly Ravine Farm, John Gilmore, Glendale, New Jersey

Generally speaking steel roofing should not be applied on top of old prepared roofing containing tar. For even a slight dampness coming from animals or other sources will cause the acid in the tar to attack the metal.

HOW TO MAKE A STEEL ROOF LAST

As with wire, the gauge numbers of roofing run inversely to its thickness. Thus 24 gauge roofing is considerably thicker than 28 gauge. In climates of average rainfall 26 gauge or heavier roofing will sufficiently outlast lighter gauges to make up for the slight extra cost. The first line of defense against rust is the galvanizing. The galvanizing alone on new roofing will protect it against the weather for a time. But if painting the roof is delayed until visible signs of rust or yellowish marks of corrosion on the galvanizing appear it simply means that so much of the roofing's original defense against the weather has been irreparably lost. It is best to paint roofing just as soon as the shininess of the new zinc or spelter in its galvanizing has become a little dimmed. If a steel roof is kept properly painted there is practically no limit to its life.

Roofs should be inspected once or twice a year. Accumulations in the gutters such as leaves should be removed, and wherever the gutters have sagged so water collects they should be adjusted. If the paint is scaling, the roof should be repainted. It pays to use a good quality paint and it should be applied when the roof is absolutely dry. Do not paint in damp or foggy weather. Scrape the metal bright with a wire brush where it has rusted. See that the sheets are tight at the joints. Replace any nails that have started.



Corrugated Roofing Laid on Purlins

Write to Department R, Bethlehem Steel Company, Bethlehem, Pa., for "Better Roofs," a practical roofing handbook, which gives detailed instructions on how to apply steel roofing.

SOLDERING JOBS

PHOTO N.Y.S.C.A.
Soldering a Large Hole

WHILE the majority of farmers have a soldering copper which they get out occasionally to mend a hole in a milk pail or one of the household utensils, by following just a few simple hints in the use of the copper, its usefulness may be increased many times. And neater and more lasting repairs may be effected. For the heating of a soldering copper a gasoline blow torch is standard equipment. By protecting the copper inside a short length of pipe or an old fork ferrule from the destructive gases, however, it can successfully be heated in the fire box of the kitchen stove or the farm forge. Necessary equipment for soldering in addition to the copper is a stick of "half-and-half" solder, an ordinary flat file, soldering flux, salammoniac and a piece of emery-cloth or sand-paper. A pair of tin snips may come in handy also.

TINNING A SOLDERING COPPER

The beginning of the trick of soldering is in properly applying a coat of solder to the copper itself. This is called "tinning" the copper. To accomplish this operation heat the copper to a temperature at which it will melt solder readily. Then file all four sides of the point until they appear bright and clean. Heat the copper to its original temperature and rub the point in a lump of salammoniac. Then apply powdered resin or zinc chloride as flux and rub each face of the point in a small quantity of melted solder that can be retained in a hollow place in a brick as shown in the illustration. Work fast so that the copper does not become too cool before the solder is applied.

Solder can be worked to better advantage with a copper that has been tinned in this manner, as the melted solder tends to cling to a copper that has been well tinned. Never heat the copper red hot. To get solder to stick hold the copper long enough on the surface of the metal to be soldered so as to bring it to the same temperature as the melted

PHOTO N.Y.S.C.A.
Tinning a Soldering Copper

solder. But in soldering soft metals such as lead, pewter or zinc care must be exercised not to hold the soldering iron against them long enough to melt them.

PREPARING THE SURFACE

The best all-around flux for farm use is zinc chloride. This may be prepared by dropping little pieces of zinc, such as from an old fruit-jar top or the outer shell of a discarded dry battery, into a bottle about one-half full of muriatic acid diluted to half strength. Keep adding the zinc until the acid will dissolve no more. Before applying the solder to any kind of metal the surface should be bright and clean. Zinc chloride is a suitable flux for soldering tin, iron and steel. In soldering iron or steel apply a thin coat of solder first. To solder cast iron, clean the parts before applying the zinc chloride flux with muriatic acid. This should be done with iron and steel if the surface is old and rusted. The straight acid without zinc in it may be employed as a flux to solder galvanized iron or zinc. Tallow is the best flux for lead. Always prepare the surface carefully before applying the solder to any metal. Scrape off rust or corrosion, then polish with emery-cloth.

TO SOLDER SMALL HOLES

The simplest solder repair job and the one most commonly called for on a farm is mending small holes in such articles as pails, milk cans and cooking utensils. File down the rough edges of the hole. Ream the hole out with some sharp pointed instrument. A twist drill rotated by hand serves the purpose well. Apply the flux being careful not to spread it to surrounding areas. With a supply of molten solder on the hot copper rotate the point of the copper in the hole. Lift the copper. Enough solder should cling to the hole to form a rivet, sealing it perfectly.

SOLDERING LARGE HOLES

Pound out the ragged edges of the hole or trim them off. Clean off a surface a quarter of an inch wide around the edge of the hole; apply the flux and coat it with a thin surface of solder. Cut a patch large enough to

cover the hole, but about an eighth of an inch shy of the dimension of the solder coated margin. Cover one side of the patch with a thin layer of solder. Place the patch over the hole with the soldered side down, holding it in place with a file or some other convenient instrument. Run the heated copper over the surface until the two soldered surfaces are "sweated" together. Care must be taken not to loosen the patch by leaving the copper too long in one place.

TO MEND COPPER TUBING

Often times from friction or other causes holes occur in copper tubing. Such holes may be mended as follows: Clean the tubing in the immediate area of the hole. Clean about two feet of soft iron wire with emery-cloth or sand-paper. Wrap the wire around the tubing in the region of the hole, allowing the wire to extend at least one-eighth inch beyond each end of the opening. Apply the flux to the wire and put on a deposit of solder in several places. Rotate the tubing on the point of the soldering copper until the solder is evenly distributed. Tubing mended in this way will be stronger at the point of repair than it was originally.

TO SOLDER LEAD

Lead tarnishes quickly. Scrape or file the surface to be soldered until it is bright then apply the tallow flux before the lustre of the fresh surface becomes dulled with oxidation. To mend a hole in lead, tin the surface surrounding it with a light coat of solder exercising care not to get the copper so hot that it will melt the lead. Then apply enough more solder to fill the hole.

To join two pieces of lead pipe enlarge the diameter of the section toward which the liquid will flow when the pipe is in use by hammering it out with a turning pin or some such instrument. Then with a file, bevel the end that is to go inside so that it fits snugly. Bring the two sections together. After applying the tallow flux melt in some solder at two or three places then spread it around evenly making a smooth joint.

PHOTO N.Y.S.C.A.

SAW FITTING

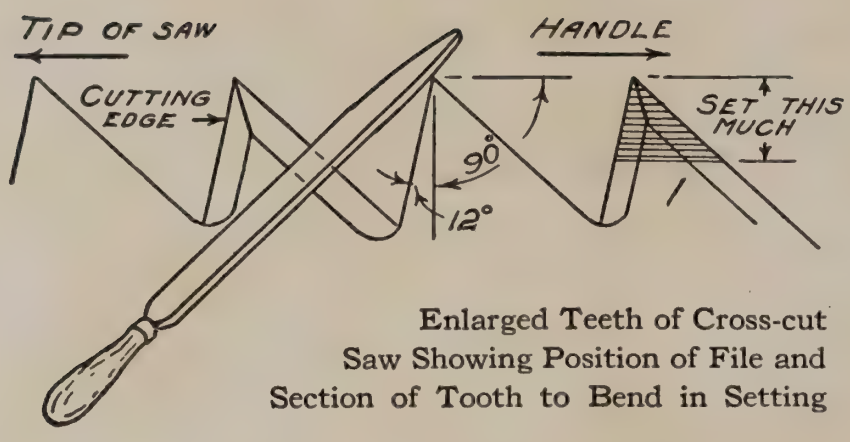
PHOTO N.Y.S.C.A.
Polishing with Pumice Stone and Water

ONE of the most particular repair jobs on the farm is fitting a saw. And the best way to avoid having to do it too often is to be forever watchful of nails in second-hand lumber. Before sawing a board examine both sides of it with an eye not only to nail heads but the shanks of old nails which may have had their heads broken off. A little watchfulness will save a whole lot of saw fitting work. If lumber is gritty, clean it off before sawing it.

The essential operation in saw fitting is the filing and setting of the saw. The other operations, polishing the sides with emery-cloth, (and if a high polish is desired with pumice stone and moist cloth), and "side jointing" are the final touches essential to the perfect job. Four types of saws are commonly used on farms, namely, the carpenter's cross-cut and ripsaws, the ordinary wood saw stretched on a frame and the one-man or two-man cross-cut saw for sawing logs. And of these four the carpenter's cross-cut is the one which, taking one farm and another, sees the most service. With some modifications the same principles that apply to the cross-cut carpenter's saw can be applied to fitting the other saws.

FILING THE SAW

The first step in fitting a carpenter's cross-cut saw is to remove the handle. Run an eye down the teeth to see if they all stick up at the same height. If some stick up higher than others file the points down by running the file directly across them. This is called jointing. Polish the saw in the manner that has been indicated. Then proceed to sharpen the teeth with firm even strokes of a three-cornered file, applying pressure always on the push of the file and bringing it back lightly. The saw should



Enlarged Teeth of Cross-cut Saw Showing Position of File and Section of Tooth to Bend in Setting

be held for these operations in a saw clamp. For evening up the teeth set the saw down in the clamp so that its bite comes close to the teeth; for the sharpening move it up so that the teeth are about 4 inches from the clamp. Hold the file level but at an angle a little off right-angles to the length of the saw. The proper angle, for a saw for general work on the farm, is 45 degrees. Commence the sharpening by filing all teeth that are set, or slant, away from the direction of the push of the file, that is, every other tooth. Bring each tooth to a sharp point. After finishing all the teeth set one way, reverse the saw in the clamp and sharpen all those slanting the other way.

SETTING AND SIDE JOINTING

The next operation is setting the saw, that is, slightly bending the teeth alternately in opposite directions, so that every other tooth is in alignment on either side. This operation is performed with a tool especially designed for the purpose called a saw set. The final touch is side jointing the saw. To accomplish this lay the blade on a flat surface and pass a partly worn-out file or abrasive stone along the side just a few times to refine the cutting edges of the teeth. If the saw runs to one side, after it is assembled and tested in use, the fault may be in the lack of uniformity in the set or because the teeth have been filed longer on one side than the other. The job should be performed where there is plenty of light and care exercised to prevent such errors. In sharpening ripsaws file the teeth straight across the blade rather than at the 45-degree angle employed for cross-cut saws. If the gullets of a cross-cut log saw have become shallow they may be gummed out or deepened with a round-backed file.

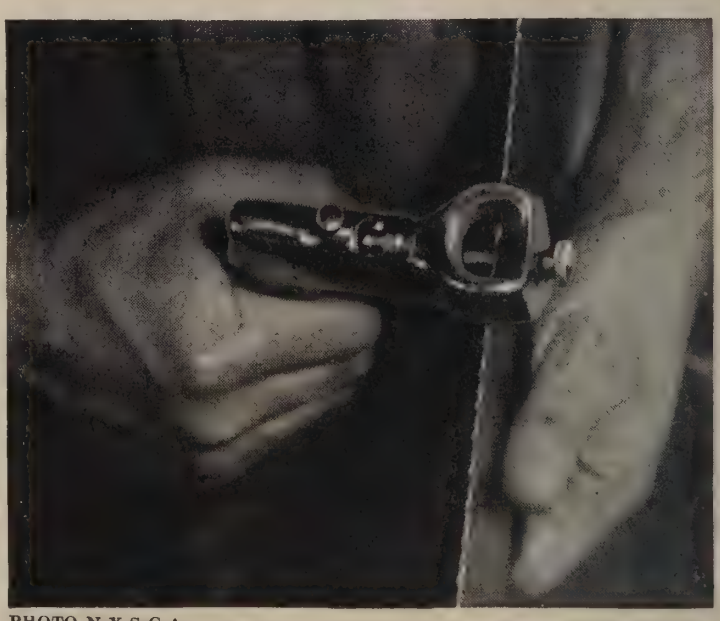


PHOTO N.Y.S.C.A.

A Saw Set

GRINDING SMALL TOOLS

ONE of the easiest ways of botching a repair job is by going at it with a dull tool. However limited the assortment of tools may be on a farm it is economy to have them of the best quality and to keep them sharp. And just as there is a right way of using every tool so also there is a right way of sharpening it.

But some general rules apply to the grinding of all edged tools. The emery-wheel or grindstone always should be run toward or against the cutting edge of the tool. By this practice the cutting edge is reinforced by the body of the tool, and a keener edge results. To prevent the surface of the wheel wearing unevenly move the tool back and forth across it. Remove the tool from the emery-wheel before it gets hot enough to destroy the temper. It is a good plan to dip it in a can or bucket of water occasionally.

Satisfactory grinding cannot be done if the wheel is "out of round." It can be brought back into true by the use of an emery-wheel dresser, a device that should always be included in the purchase of an emery grinder. To true the wheel simply hold the dresser on the tool rest near enough so that it ticks the high places, gradually bringing it nearer as they are worn down, until they disappear.

TO GRIND A COLD CHISEL

It will save time in grinding a cold chisel to commence by holding the edge squarely against the grinder until the nicks are ground out. Then sharpen it, grinding first one side and then the other in order to bring them down evenly. Cold chisels work best if ground to an angle of about 60 degrees.

SHARPENING A WOOD CHISEL

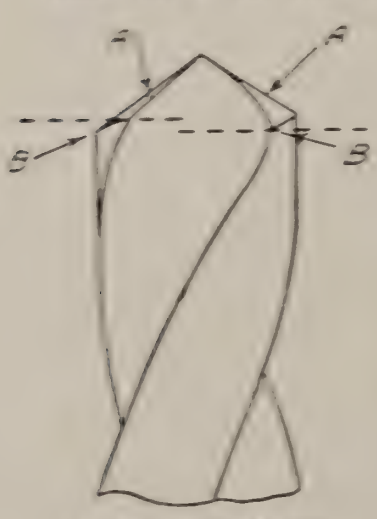
Tools for cutting wood need grinding only if they are extremely dull or have been nicked. A tool that is kept sharp by frequent application of the oil stone needs grinding only occasionally and lasts that much the

PHOTO N.Y.S.C.A. Grinding a Twist Drill

longer. If a chisel has been nicked the first step is to hold its edge squarely against the grinder until they have disappeared and the edge is evenly squared off. Then proceed with the sharpening, grinding it on the bevel edge only. The length of the bevel is determined partly by the work to be done. The longer the bevel, the thinner the cutting edge will be. A bevel $\frac{1}{4}$ inch long is suitable for chisels used in general work. In order to insure an even bevel it is best to hold the chisel against the tool rest, returning it to the grinder each time it is removed at the same angle. When the chisel has been brought to a feather edge on the grinder, finish it on the oil stone by removing the feather edge with a few even forward strokes.

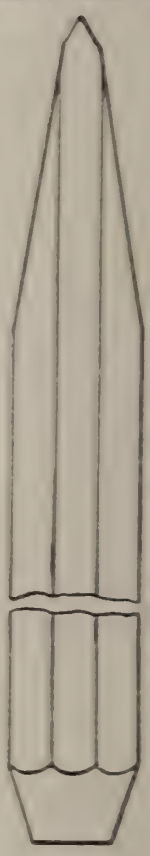
GRINDING A TWIST DRILL

Grinding a twist drill is a relatively delicate operation, particularly the smaller sizes. For it is necessary to properly form the cutting and trailing edges as well as to get the point evenly beveled. Hold the drill in both hands as indicated in the picture at an angle of about 59 degrees. Press the cutting edge against the face of the grinding wheel. With each stroke of the drill on the grinding wheel, lower the shank and at the same time rotate the drill clockwise. A properly ground drill will have a regular, slightly rounding surface from the cutting edge to the trailing edge. This is preferable to a flat surface because it makes a stronger backing for the cutting edge. If the drill is ground correctly, each lip will cut a spiral coil of metal as it is forced into the iron.



A.—Cutting Edges
B.—Trailing Edges

Cut a "V" notch in a small piece of tin at the proper angle for the two cutting edges. This is known as a templet. As the grinding proceeds this templet may be fitted over the cutting lips from time to time to determine if the bevel is correct.



Proper Bevel for Cold Chisel

HARNESS REPAIRING

ONE of the most profitable rainy-day occupations on the farm is going over the harnesses. If dry and hard, they should be washed and oiled. And since in order to do a good harness washing job, it is necessary to take the harness apart, this is an excellent time to inspect it for signs of wear. Perhaps it is noted that the sewing on a rein has commenced ripping, or that the rivet holes have become loose where the tug fits into the hame-clip. If the proper attention is given to such signs of wear before a complete break occurs, a breakdown on the job may be thus prevented. And, too, a small repair job attended to in time often saves a much bigger and harder one.

The tools required for harness mending are quite simple and inexpensive. Emergency repairs can be effected with rivets of the solid or split copper variety, or with tubular iron rivets. The tubular iron rivets are applied with an inexpensive riveting machine. Hollow rivets hold the leather securely and are very convenient to use as it is only necessary to press down the levers of the machine and each rivet cuts its own hole. Split rivets are also easy to use, as they need only to be driven in with a hammer and clinched down. Because of the ease with which they may be removed split rivets are desirable for a temporary job that is to be replaced by a more permanent repair later.

A lever-operated leather punch adjustable to several sizes of holes is essential for making the holes for solid rivets. After the rivet is put in, a washer is placed over the end and it is headed down firmly against it. Solid rivets of this type have the advantage of holding the leather tightly and come in boxes of

PHOTO N.Y.S.C.A

Sewing Harness

PHOTO N.Y.S.C.A.

The Threads Ready to Wax

different lengths suited to a wide variety of repair requirements. A hollow punch and hammer may be used to make a hole in thick leather or a hole that is too far from the edge for the adjustable punch to reach. A small twist drill may also be used for making holes in traces and other thick straps.

TO SEW HARNESS

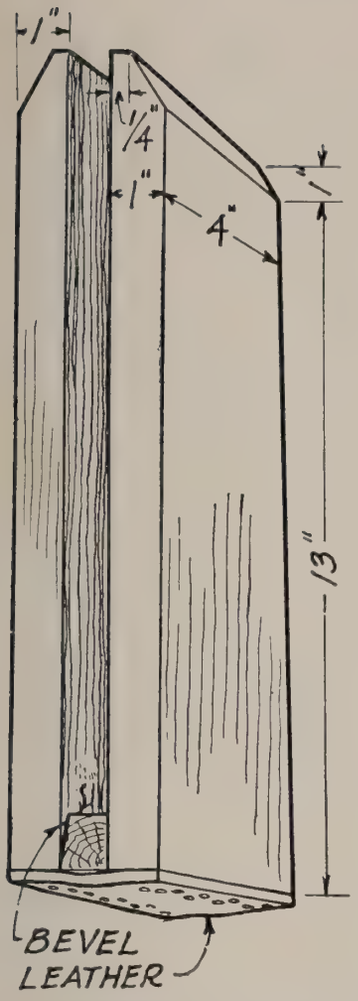
As far as possible the permanent repairs on a harness should be sewed. For a riveted repair on a harness is hard on the leather and is, besides, a constant nuisance in harnessing and unharnessing. And while sewing leather is one of the skilled trades, a working competence can be attained at it if a few general hints are followed out faithfully.

The key to success in sewing leather is in properly preparing the waxed linen thread that is used. No. 10 linen thread is the size employed for sewing harness. Several strands of this thread have to be twisted together and waxed and "waxed ends" prepared before a harness sewing job can be successfully entered upon. The number of threads required varies from 3 for such work as the light stitching on reins to 6 or 7 for the heavy stitching of tugs.

The fine art in preparing the thread is in making the sort of waxed end that can be worked into a fine point. With this in mind the sewing length of thread desired should be unraveled so that the fibres can be pulled away from each other in a slanting kind of tear rather than being broken off, and so leaving a blunt end. The unraveling of the thread is accomplished by rolling it with the palm of the hand on the thigh at the point at which the tear is to be made. Tear off in this way as many threads as are required. Thus if the repair job is sewing reins, 3 or 4 would be required. Be careful to get them the same length. Then, holding the threads together, straighten them out so that the end of the first thread sticks out beyond that of the second, and so on, as shown in the illustration. By this means, when the separate strands are combined into a single thread for sewing, its ends also will taper off.

WAXING THE THREAD

Rubbing on the shoemaker's wax after the threads have been thus torn off at sewing length is relatively simple. To wax the ends, stretch the threads double over a convenient hook or nail and thoroughly rub in



Home-Made Harness Clamp

the wax, using for this purpose a small piece of pliable leather known as a pad. Before applying it warm the wax until it is soft and smear a small quantity of the warm wax on the flesh side of the leather. Twist the three ends together after they have thus been waxed by rolling them on the palm of the hand. After the ends are properly waxed and twisted the thread may be twisted throughout its entire length by rolling it on the thigh. After each roll grasp it firmly between the thumb and forefinger to prevent the strands from untwisting again. After it has thus been sufficiently well twisted draw it back and forth over a nail or hook to even the twist throughout its length. Then apply wax to the rest of the thread in the same manner it was applied to the ends.

The over-and-under stitch that is employed in harness repair work is worked from the middle of the sewing length with a needle at either end. This is why it is necessary to supply two waxed ends. To thread a harness needle stick two or three inches of the pointed waxed end through the eye, and bend this two or three inches of tapered end back into the main thread. The holes that take the thread in harness sewing are made with an awl. To get the holes even and at the right distance from the edge of the strap employ a wheeled edging tool. The sharp points on the little wheel make marks the right distance apart for the awl holes. If the thread binds in sewing, rub beeswax on it, being careful not to get any on the ends, as beeswax is of different consistency than shoemaker's wax and will prevent the ends from sticking.

A HOME-MADE HARNESS CLAMP

The straps should be tightly held together in the desired position when the awl holes are made, and also for the sewing, by means of a harness clamp. Such a clamp may easily be contrived as indicated in the picture by beveling the ends of 2 short lengths of 4-inch boards and hinging them together at the other end with a piece of leather. The clamp is held apart at the bottom by a $\frac{3}{4}$-inch square strip beveled slightly on one side and nailed on the other side to one of the boards. The jaws of the clamp are held together when it is in use by placing it in the iron vise.

FARM BLACKSMITHING

THE crowding out of the country blacksmith by the automobile has left many farmers high and dry for a place to get their horses shod and repair work done. And from necessity, though blacksmithing is one of the more highly skilled trades, many farmers have had to undertake their own blacksmithing work. Thus a survey of the state of Pennsylvania that was made a few years ago showed that quite a percentage of farmers do their own horse shoeing and forge repair work. The investment in a small forge and the few tools that are essential to the kind of iron work repairs that are ordinarily called for on a farm is not great. However, it takes some time to get a blacksmithing repair started, due to the necessity of kindling the forge. And some experience, as well as the following out of directions, is essential to competency at this trade.

Aside from a forge and an anvil the essential tools for farm blacksmithing consist of a pair of pick-up tongs, a ball-peen 1½-pound hammer, a steel taper punch, a cold chisel, a 2-pound cross-peen hammer, a pair of flat-jaw tongs, bolt tongs and a hardy which fits into the anvil and is used for cutting hot iron by striking against it with a hammer.

The beginning of the knack of blacksmithing is in properly building the forge fire. After cleaning out the forge grate or tuyere, place in a large handful of shavings. Then rake in the clean coke on the back and sides and over the top, but leave the front open. Light the kindling and after it is well started turn on a weak, steady blast. Then put a few shovels of green coal around the outer edge of the coke. After the fire is well started there will be a center of burning coke in the middle of the forge and directly over the tuyere where the irons are heated, and a circle outside of this area where coke is forming from the green coal, which serves to limit or bank the fire.

©KEYSTONE PHOTO

Today Many Farmers Have to Do Their Own Blacksmithing

A strong draft which will provide more oxygen than the fire will use should never be forced through the fire, as the free oxygen will attack the iron or steel and cause excessive scaling.

Forging a Pick Head

HOW TO RECONDITION TOOLS

When such a tool as a cold chisel has become badly nicked it is easier to forge it down and reharden it, rather than to attempt to grind out the nicks. With modifications, the same reconditioning treatment may be applied to other edged, or sharp pointed tools.

To remove the nicks in a cold chisel heat it to forging heat (light cherry red), then with good heavy blows of the ball-peen hammer "flow" the metal down from the shoulders by working the blows gradually toward the cutting edge of the chisel. The nicks will be pushed out into a thin edge that may then be squared by cutting it off on the hardy. To give the chisel a cutting edge, grind it after hardening.

HOW TO HARDEN A COLD CHISEL

To harden a cold chisel bring it to a heat that is somewhere between a full cherry red and a light cherry red. Then quench it by immersing about an inch of the end of it in water, moving it up and down, the while, so no sharp dividing line will result between the hardened end and body of the chisel. After the point has become cold, gradually work the chisel further into the water until it is immersed to about half its length. Now remove it. Permit the water to dry off and polish the end for an inch or so by rubbing it on emery cloth in order to see the "temper" colors.

The heat stored in the portion of the chisel which was not immersed will presently commence to run back into the point. As it does so, oxides will be formed by the air acting on the polished surface. These oxides will vary in kind and color as the point becomes hotter, appearing in the following sequence: light yellow, faint yellow, straw color, dark straw, dark yellow, brown yellow, spotted red brown, purple, blue, full blue, Polish blue, dark blue. As the brown yellow reaches the cutting edge, dip the entire chisel in water. The rule in tempering is, briefly, the lighter the color the harder the steel. Grind a cutting edge on the tool and it is ready for use.

HOW TO WELD

One of the commonest demands of farm blacksmithing is for a welding job. Iron passes through definite stages when it is heated. From a dark gray it turns to red, then changes to yellow, light yellow and finally white. These are the indications that the proper welding heat has been reached. Very soon after it gets to the light yellow stage sparks are given off and the surface seems to flow back and forth.

If heated too hot the iron is "burned" and thus weakened. Yet it must be brought to the welding heat, which has been indicated, in order to get the weld to hold. Borax is often used as a flux to aid in welding.

The first step in making a weld is to shape the surfaces so that they will fit together in the desired fashion when the weld is completed. Thus, in the weld that is required in making a chain-link, forge the ends into "scarfed" or slanting surfaces that will fit together evenly when welded. In welding a rod "upset" the ends that are to be joined by forging the metal back, making the ends thicker than the rest of the rod. The purpose of this is to increase the area of the welded surfaces. After the weld has been completed the rod may be re-heated and forged to a uniform diameter if desired. Heat the iron to a light cherry red for all forging operations.

PHOTOS ON THIS AND PRECEDING PAGE FROM "FITTING FARM TOOLS," BY L. M. ROEHL.—COURTESY BRUCE PUBLISHING COMPANY, MILWAUKEE, WISCONSIN.

A Strong Draft May Cause Excessive Scaling

PIPE FITTING

PHOTO N.Y.S.C.A.
Threading a Pipe

PIPE fitting has a language of its own, such as, "Y bends," "reducing T's," "mall offsets," and so on. These are the names of pipe fittings for various purposes. But for most jobs unions of the ordinary "T" or elbow types suffice, and even though the amateur may not know the names of the more specialized fittings he can usually describe them well enough to a hardware clerk so as to get the type desired. Nor is any great assortment of tools necessary for the ordinary pipe fitting job. But those which are indispensable are a pipe stock and set of dies, or an adjustable die, a sixteen-inch pipe wrench, a single-wheel pipe cutter, a twelve-inch half-round file, a pipe vise, and white lead or thick paint for sealing the joints. It is a good plan also to have a few feet of pipe on hand of sizes that are likely to be called for to make repairs and also the fittings that are likely to be required.

In making measurements for pipe fitting jobs and ordering the necessary lengths and sizes as well as the fittings it is rather necessary to have a knowledge of some of the general terms and practices that prevail in this trade. The "male" union is the smaller one that goes inside; the "female," the larger one that it fits into. When more than one piece of pipe is used in making a length it is known as a "run." In making a run, allowance should be made for the amount of pipe that screws into the fitting as well as the space occupied by the fitting itself. Parallel pipes are measured from center to center. Pipes running at right angles to each other are measured from the center line of one to the end of the other. The size of pipes is designated by their inside diameters.

Pipe threads have been standardized according to pipe sizes. Thus it is possible to tell from the size of a pipe which has already been threaded what number of thread to cut on the union to be joined to it. Pipes of

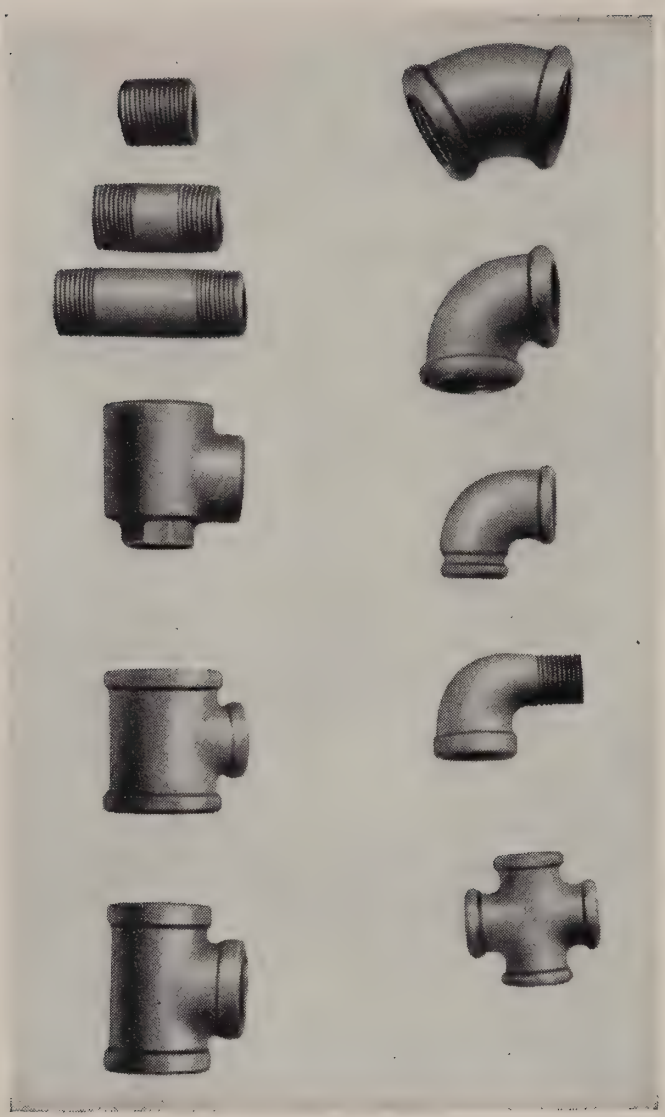


PHOTO N.Y.S.C.A.

Standard Pipe Fittings

¼-inch inside diameter have 18 threads to the inch; ½-inch and ¾-inch pipes have 14 threads to the inch; 1-inch and 2-inch pipes have 11½ threads per inch; larger pipes, such as 2½-inch pipes and larger have 8 threads to an inch.

Use a pipe vise to hold pipe for cutting or threading. In threading a pipe hold the handles of the pipe stock at exactly right angles to the pipe to avoid side thrusts. Ream out the inside burr made by the pipe cutter with the half-round file. Then select the proper sized die and guide to fit the pipe. If a solid die is used, be sure that the large diameter is facing the end of the pipe. Slide the guide over the end of the pipe, and pressing the stock firmly rotate it to the right. The pipe stock should not be turned continuously on the pipe until the threads are cut, but should at intervals be rocked backwards, to free the dies of metal chips. While cutting the threads lard oil or a special thread-cutting oil should be used to prevent rapid dulling of the dies and injury to the threads being cut. When the die comes flush with the end of the thread the proper amount of thread has been cut. Daub all unions with white lead or thick paint before assembling them.

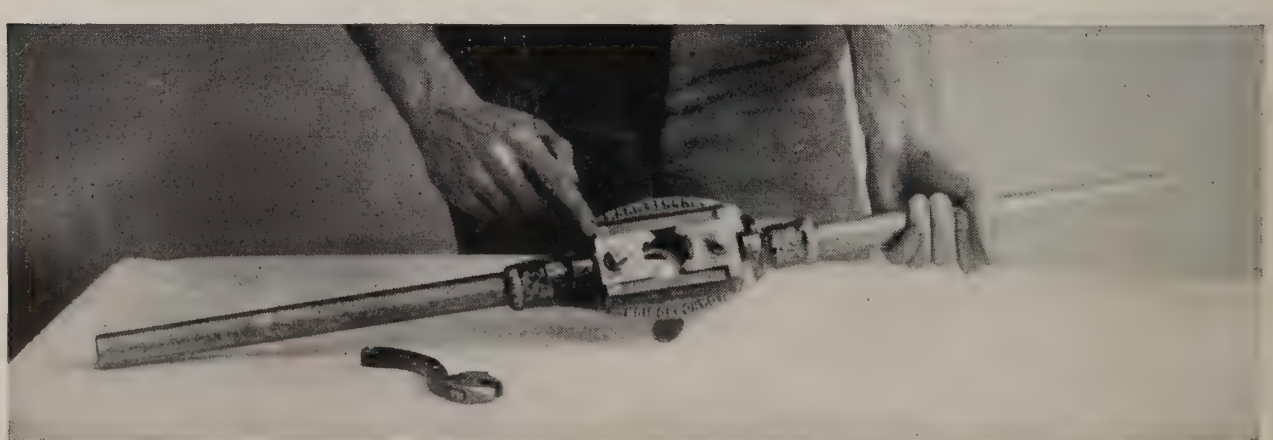


PHOTO N.Y.S.C.A.

A Pipe Stock with Dies in Place

TIPS ON THE CARE OF FARM MACHINERY

EASILY, one of the chief sources of preventable waste on many farms is that caused by the neglect of farm machinery. As soon as the season's work is finished every piece of farm machinery should be stored away in a dry place under cover. If there is no available space in existing buildings it is money in the farmer's pocket to erect a tool shed, which, since warmth is no consideration, may be built very cheaply. Sheet steel roofing laid on purlins will do excellently for the roof of such a building, and if desired it may be employed for the sides as well. Plough shares and similar bright parts of implements or machines should be coated with grease.

Not all the signs of wear on a machine are of the visible kind. Many of them announce themselves by knocks or rattles when the machine is in operation. For this reason the operator at the end of the machine's working season usually knows at that time exactly what it needs to have done to it. And while it is well to inspect machines before putting them into use it is also a good plan to make detailed notes when the season's work is finished of the repairs that the machine requires. These notes may be kept in a shop notebook, or, better, they can be placed on a tag fastened to the machine itself.

Examine the machine carefully at the time the notes are made, noting especially if there are worn parts, such as pawls or gears, that it might be advisable to replace before another season's work. If adjustments are needed notes should be made of these also. A tag for the ensilage cutter after the silo is filled might run something like this: "blower shaft vibrates, bearings loose; knives dull; apron sprocket cracked"—and here the number of the sprocket should be noted for ordering purposes, such as, "113 A." After the fall ploughing is finished and all the machines laid away for the winter it will then be possible to go over these tags and either send to the manufacturer

for the parts required or secure them from the local dealer. If it is necessary to send away for them it may be possible by this practice to combine orders for parts of several different machines from a single manufacturer, thus saving shipping expenses. And in any case if the parts are secured before the working season they will be on hand to commence the next season's work without delay. If the number of a part is not known always give the year in which the machine was made and the model as well as describing the part desired.

When putting a machine or implement of any kind into use be sure that it is in proper adjustment for the work to be done. Implements that can be operated after a fashion even though they are not in correct adjustment have to be checked most carefully. For with the beginning of each season, and also with each new job working conditions are likely to vary. Thus it is very important to check carefully the adjustments of such a tool as a sulky plow. For while it will operate even if it is considerably out of balance, the draught may be considerably heavier than necessary, if the coulter, wheel and tongue adjustments are not adapted to the requirements of the soil.

Scrape off mud and dirt that has accumulated on machines during the working season when they are put away. Inspect all bearings and gear housings before putting the machine into operation to see that they are free of grit. It is a good plan to clean out old gudgeon grease in the gear housings each season and to repack them with fresh grease. Many farmers who keep their buildings well painted never give a thought to painting farm machinery when it needs it. Yet a fresh coat of paint on the iron or wooden parts of farm machinery not only protects it from the weather, but serves to remind the hired help that it represents an investment that is deserving of the best of treatment.

©KEYSTONE PHOTO

Signs of Wear Announce Themselves While the Machine Is in Operation

NAILS

FIRST came thongs of buckskin and vegetable fibres; then, nails. The wrought iron nails of a few generations ago were laboriously pounded out by prison labor. These hand-wrought nails are today collected by antiquarians. The modern nail is made of steel wire by automatic machines. Each machine surpasses in productiveness the whole crescendo of ringing sledges that was the typical sound of the large prison workshop of only yesterday. Nails as they are today available, made to uniform dimensions by automatic machines, and in a great variety of shapes and sizes, are an indispensable requisite on the farm. As such, although they represent a very minor expense, they deserve more than a passing thought.

A carpenter's hammer is one of his pet tools. It has good steel in it and he has paid the price for it that a quality product deserves. Here are a few tips on nails that an experienced carpenter offers. Have a good hammer with a hang and a balance to it that appeals to you personally, just as the balance of his favorite bat appeals to a ball player. Drive strong and true; moderate the blows to the size of the nail. Stop pounding when the nail is firmly in. Don't try to drive spikes with a light-weight claw hammer; use a sledge. And, most important, use the right nail for the right purpose.

The following is a list of sizes and types of nails which may well be kept on hand for farm use; ordinary wire nails, sizes, 6, 8, 10, 16 and 20; finishing nails, sizes, 4, 6, 8 and 10. Supplies of nails of other sizes will be left over from various jobs from time to time. Have a sufficiency of compartments in the nail bin in the shop to accommodate the types of nails that have been listed and a few extra bins for the left-overs. There is a place on every farm for a junk pile. Old nails belong there. It hasn't been economy for farmers to use old nails since the days when they were pounded out by hand in the prison workshop. But never leave old nails scattered about. Horses' feet and automobile tires are too valuable.

Drive a Nail Strong and True

BOLTS

ALL machines are held together with bolts which break, come loose, and fall out. And thus, paraphrasing the old nursery rhyme, for lack of a bolt the machine won't go. For lack of a machine farm operations come to a dead halt. Indeed, at such times the farm and all its broad acres pivot on a bolt. And a bolt, with the proper nut and washer to go with it, although it represents an investment so small that it is trifling, is nevertheless the infallible remedy.

If by some occult power a farmer could tell in advance which bolts would fail him, his repair problems would be greatly simplified. Lacking help of the occult, however, it is an excellent plan to have on hand an assortment of the types of bolts, nuts and washers that are most likely to be needed. Every farmer has some idea of the sizes and lengths of which he is most often in need from experience. An inventory of equipment with an eye to bolts should also be helpful in making a selection to keep on hand. The next step is the very simple one of getting them. But simple as it is to get the bolts, this is exactly where the average farmer falls down. A bolt is such a trifling thing—except when it is needed. Every farm should have its assortment of bolts and the appropriate nuts and washers, stored away in an orderly manner so that in the hour of need the right bolt can readily be found.

SIZES FOR FARM USE

A study of bolt requirements on an average farm was recently made by the department of rural engineering at the New York State College of Agriculture. Numbers of typical implements and wagons on farms in several different regions were studied and records made of the sizes of the bolts found loose, lacking, or which experience indicated were likely to be lost. As a result of this survey an assortment of 100 bolts was recommended for the average farm, including 23 different sizes, and also a selection of nuts and washers to go with them.

Machine Bolts Left, Square Right, Hexagonal

Round-Headed and Countersunk Carriage Bolts

It may simplify matters to have this assortment made up exclusively of square-headed machine bolts, as indeed is recommended in this study. The reason for confining the selection to bolts of this type is that machine bolts are so often the only kind that can be used in making repairs on machines; and while round-headed bolts are generally more suitable for woodwork and some other purposes the square-headed bolt can be used in an emergency for most any purpose.

Lock washers or lock nuts should be employed on bolts that are subjected to vibration or friction which tends to loosen the nut. Lacking this device, it will help to use two nuts if there is room for them. A common practice that may serve very well to keep the nut on, if there is no likelihood that the bolt will at some future time have to be removed, is to slightly head the end after the nut has been screwed down. The report that has been referred to recommends that 5 lock washers of each of the following sizes be included in the farm bolt assortment: 3/16, 1/4, 5/16, 3/8, 7/16, 1/2 and 5/8.

BOLT ASSORTMENT, INCLUDING NUTS

Size	Threads per Inch	Length	No.	Size	Threads per Inch	Length	No.
1/4	20	1 1/2	5	7/16	14	1 1/2	3
		2	5			2 1/2	3
		3	5			3 1/2	4
		4	5			4 1/2	2
						6	2
5/16	18	1 1/2	5				
		2	5	1/2	13	1 1/2	3
		3	5			2 1/2	3
		4	5			3 1/2	4
						4 1/2	2
3/8	16	1 1/2	10			6	2
		2	5				
		2 1/2	6				
		3 1/2	6				
		4 1/2	5				

EXTRA NUT ASSORTMENT

Size	1/4	5/16	3/8	7/16	1/2	5/8
Weight (Ozs.)	2	2	10	4	6	10
Approx. No.	8	5	15	5	5	5
Thread per inch	20	18	16	14	13	11

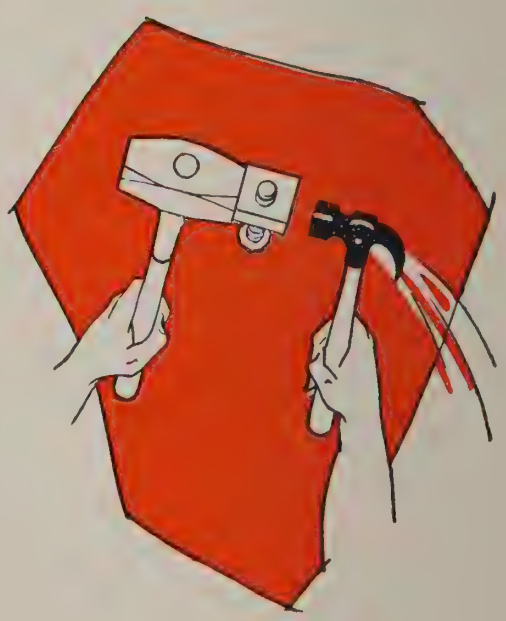
PLAIN WASHER ASSORTMENT

(To be included with the farm bolt assortment.)

Size	3/16	1/4	5/16	3/8	7/16	1/2
Weight (Ozs.)	1	4	8	16	8	16
Approx. No.	25	40	35	70	25	25

HOW TO GET A RUSTED NUT OFF

If a nut is badly rusted and hard to get off it may sometimes be loosened by holding an iron or hammer against one side of it, then giving the other side of it a smart blow. The operation should then be repeated with the other two faces, or with each opposite pair of faces if it is a hexagonal nut. Also application of the blow torch to the nut will sometimes start it by expanding the nut more rapidly than the bolt at its core. But if the bolt is to be replaced the simplest method may be to split the nut with a cold chisel, or to saw the bolt off below it with a hack saw.



Loosening a Rusty Nut

MATERIALS FOR FARM USE MADE BY BETHLEHEM STEEL

THE MODERN farm is like a great unroofed factory. All that goes on is subject to the changes of the weather. Each day and each season calls for its own program and presents its emergencies. No vocation calls for greater adaptability than farming. Thus the equipment which is employed on the farm must have qualities that fit it to demands which are exceptional, and often unforeseen, as well as meeting the demands that are placed on it normally.

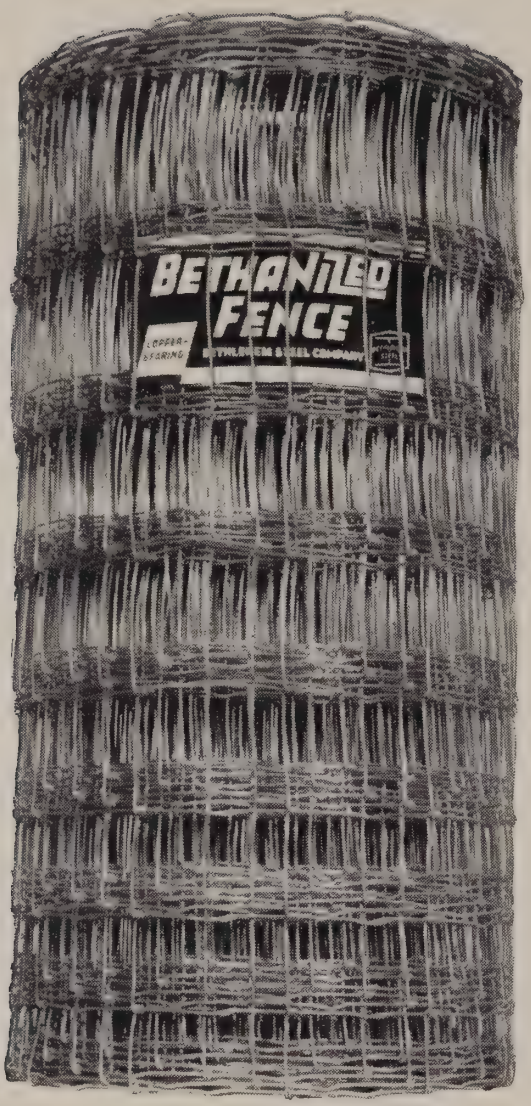
Because equipment or materials of iron and steel are so important on the modern farm, this applies particularly to them. Bethlehem products of iron and steel for farm use are well suited to the exactions of farm conditions because of the many years during which they have been perfected and constantly adjusted to a great variety of uses. Included among these materials made by the Bethlehem Steel Company for farm use, are bethanized woven fencing, barbed wire, lawn fence, flower bed guard and trellis, farm and lawn gates, steel posts, bale ties, staples, nails, steel roofing and other galvanized sheets, steel pipe, steel beams and structural shapes and many different types of bolts, nuts, washers and other fastening devices.

BETHANIZED FENCE

A ZINC COATING THAT IS UNIFORM, CRACK-PROOF, 99.99 PER CENT PURE

NO THIN SPOTS TO GIVE RUST A START

BETHANIZED coatings are deposited electrically, atom by atom, as the wire passes through a solution. The current flows uniformly into all parts, automatically making a tight, even coating. Even if we tried, we couldn't apply the zinc unevenly. This is an important feature, as however heavy a zinc coating may be, it is not effective protection if it is not of the same thickness all around the wire. The life of the coating is no greater than that of the thin spots.



Bethanized Fence is armored against the weather by a tried-and-proved zinc coating that is applied electrolytically.

EXCEEDINGLY DURABLE ZINC IN THE BETHANIZED COATING

Bethanized fence doesn't rely only on uniformity of the zinc armor for its durability. Scientists know that it is impurities in the zinc that cause ordinary coatings to weather away. The bethanized coating is 99.99-per-cent-pure zinc all the way through. There's no layer of zinc-iron alloy as found in coatings applied by older methods. This unique degree of purity means that bethanized fence is highly weather-resistant — that it is good for many extra years of service.

NOT EVEN A FEATHER CRACK FOR WEATHER TO GET IN

Because the bethanized coating is practically a part of the wire, it doesn't flake or peel in the fence-weaving operations. Bethanized wire can even be bent flat back on itself without injury to the coating. Run your fingers over the joints in a roll of bethanized fence. Notice how smooth the surface is, how there's not a trace of roughness to be discovered, no place where rust can get a start. Notice, too, the high lustre of bethanized fence, outward sign of quality.

A TRIED-AND-PROVED PRODUCT

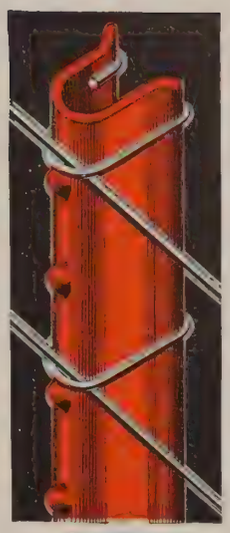
While bethanized fence represents the last word in development of methods of applying zinc to wire, both the product and the process have been thoroughly tried and proved. Bethanized wire and the bethanizing process have stood the test of time in scores of applications where zinc-coated wire had never served before.

YOU PAY NO MORE FOR EXTRA BETHANIZED VALUE

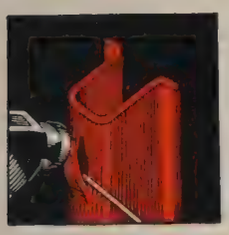
Of tried-and-proved hinge-joint construction, all bethanized fence is woven of copper-bearing wire. Its through-and-through quality sets entirely new standards of fence value — yet you don't pay a cent more for the extra years of service in every roll of bethanized fence.

STEEL FENCE POSTS

STEEL fence posts are easiest to erect and make the best-appearing fence. Bethlehem Studded Omega "U" and Erecto Posts are made of new-billet steel. Their U-shape gives them extra rigidity and their large, heavy anchor plates provide ample resistance to side strains on the fence. The Omega is a heavy-weight, all-purpose post. The Erecto is lighter in weight and is of the self-fastener type. Strong tubular corner posts are made for use with both Omega and Erecto Posts—angle end and corner posts are also available.



OMEGA

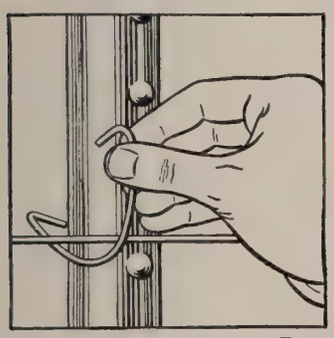


ERECTO POST

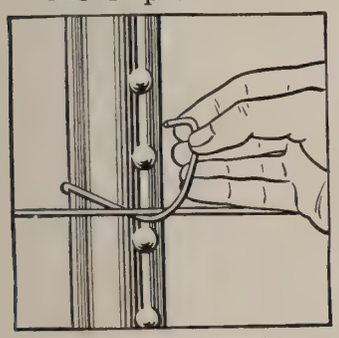
A TAP WITH THE HAMMER CLOSES THE SELF-FASTENER LUG ON BETHLEHEM ERECTO POSTS.

Anchor Plate for both Erecto and Omega Posts.

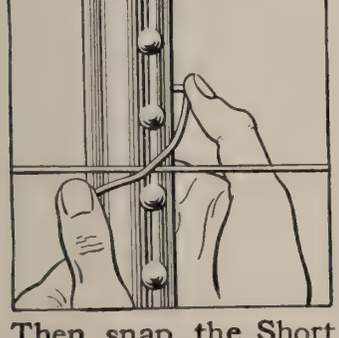
APPLYING THE SNAP-ON, SNAP-OFF BETHANIZED WIRE CLIPS FURNISHED WITH OMEGA POSTS.



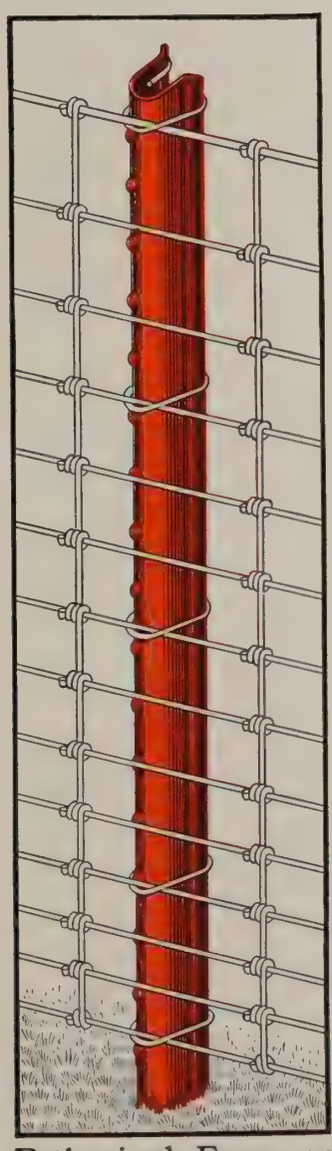
Engage the Long Leg of the Clip with



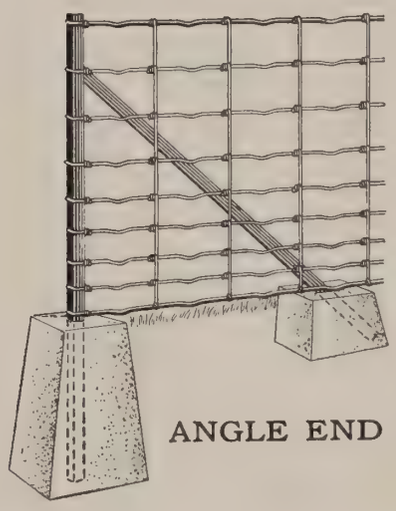
the Side of the Post.



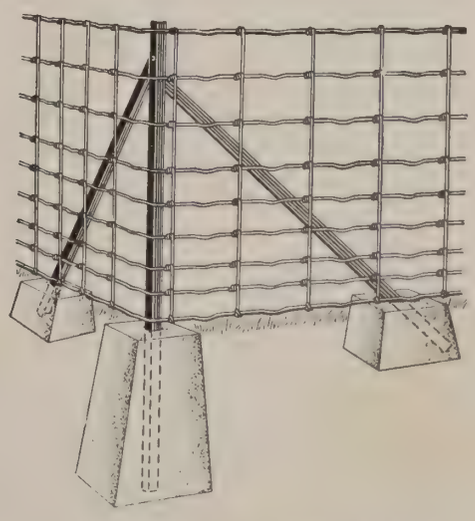
Then snap the Short Leg Into Place, securely fastening the Line Wire.



Bethanized Fence on Omega U Post

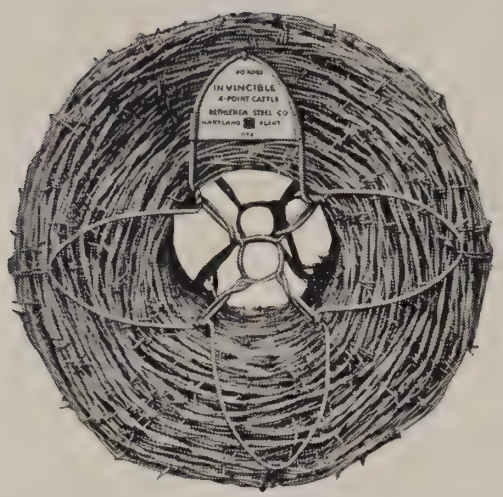


ANGLE END POST



ANGLE CORNER POST

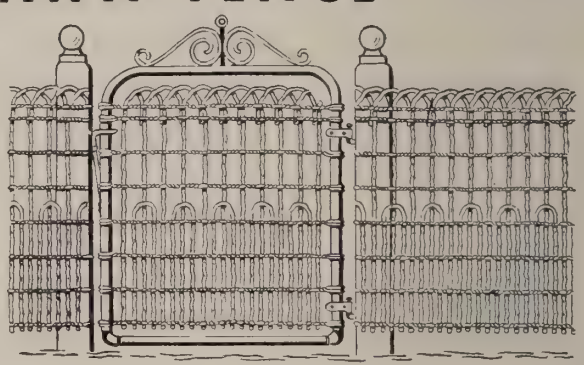
BETHLEHEM BARBED WIRE



Bethlehem Barbed Wire Is Made in Every Standard Type

BETHLEHEM Barbed Wire is made in a sufficient variety of styles and specifications to meet every farm-fence requirement to which barbed wire is adapted. It is supplied, either galvanized or painted, on 80-rod spools. Smaller reels can be supplied at proportionate prices. The strands are uniformly twisted, the barbs sharp, tightly wrapped and equally spaced. Two-point cattle barbs are 5 inches apart; two-point hog barbs, 3 inches apart; four-point cattle barbs, 6 inches apart; four-point hog barbs, 4 inches apart. Bethanized barbed wire can be secured on special order.

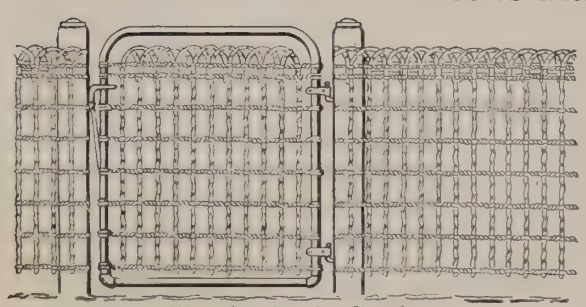
BETHANIZED LAWN FENCE



Double-Arch Style

DUE to its silvery lustre bethanized Lawn Fence sets new standards in its smart appearance — and new standards, also, in coating weight and coating durability. Bethanizing now makes possible a heavy-coated lawn fence. The same properties of the bethanized coating that add to farm fence life permit coatings just as heavy and superior on lawn fence. With bethanized Lawn Fence frequent painting is unnecessary. It retains its brightness and attractive appearance for years.

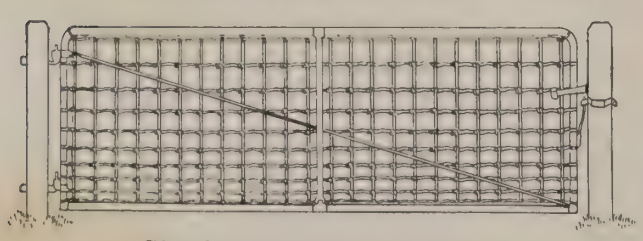
Bethanized Lawn Fence is made in both Single-Arch and Double-Arch styles. Walk gates, and both Single and Double Drive gates, are furnished for use with bethanized Lawn Fence.



Single-Arch Style

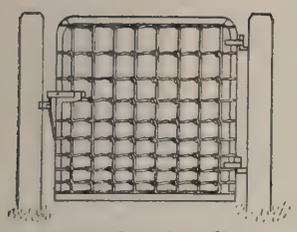
Convenient for lawn use, also, are bethanized Flower Bed Guard and bethanized Trellis.

BETHLEHEM FARM AND LAWN GATES



Single Drive Farm Gate

GATES of modern construction are the logical complement to modern fences. Bethlehem Farm Walk and Single Drive Gates have frameworks of strong galvanized

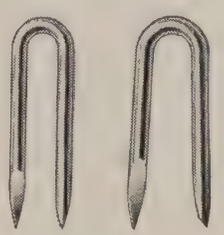


Farm Walk Gate

tubing and the filler is of bethanized fence with graduated line wires and the stay wires 6 in. apart. Of similar sturdy construction are Bethlehem Poultry Gates, which have a filler to match the bethanized Poultry Fence.

NAILS AND OTHER WIRE PRODUCTS

IN the great wire mills at Johnstown, which make bethanized fence, a variety of other wire products are also produced which have important use on the farm. Galvanized and bright fence staples, for use with wooden posts, and galvanized poultry netting staples are included among these products, also steel fence post staples. Bethlehem wire nails are made in all the standard sizes ranging from the smallest brads in small paper packages to the largest spikes. The staples for wooden posts are of No. 9 gauge wire and from 7/8 to 2 inches in length. The staples for use with steel posts are of No. 10 gauge, 1½-inch length and 3/8-inch spread.



Galvanized Staples

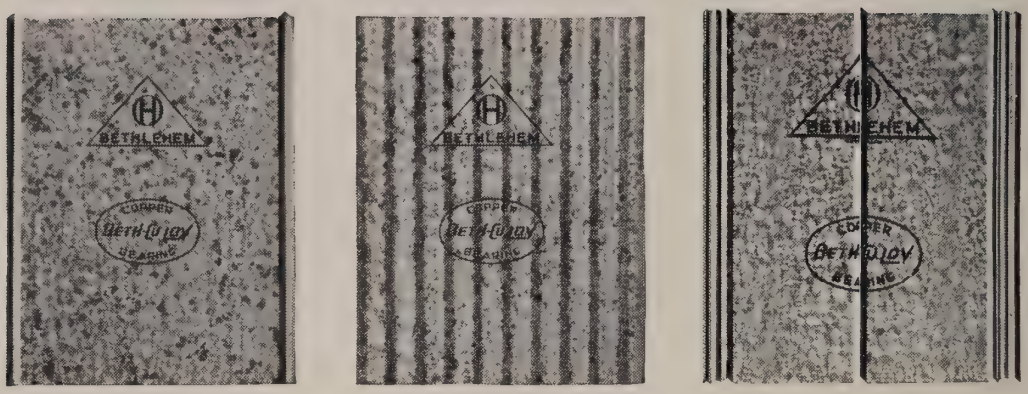
Left: For Punched Steel Posts

Right: For Wooden Posts

SILVER STAR BALE TIES

Bale ties are a wire product which Bethlehem has supplied for farm use for many years. Bethlehem Silver Star bale ties are provided with either regular oval or long oval loops and are made of a special grade of annealed steel which makes them so soft that they are easily applied, yet so strong that they hold even the most tightly compressed bale. They have a smooth hard oil finish that makes them easy to handle and retards rusting. They are shipped in a spirally wrapped bundle which Bethlehem originated that is easy to undo and prevents the ends from catching in handling.

BETH-CU-LOY SHEETS

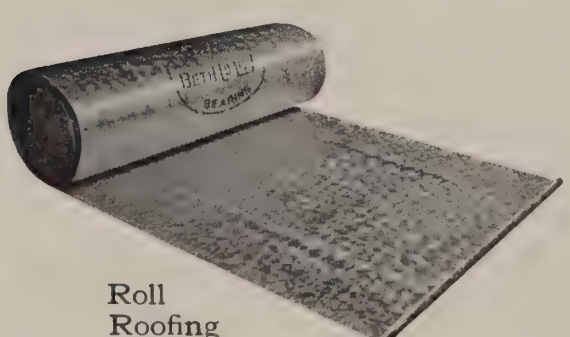


V-Crimped Corrugated Stormproof

GALVANIZED ROOFING SHEETS

MANY of the farmer's profit-snatching enemies work ceaselessly day and night. Rust is one of them. Steel roofing, because of the protection that it affords against lightning and fire as well as against the elements, is one of the most desirable roofs for use on the farm. Farm buildings roofed with Beth-Cu-Loy, copper-bearing, galvanized steel roofing may be regarded as more permanently provided for than buildings roofed with ordinary steel roofing. For Beth-Cu-Loy copper-bearing steel has just the content of copper in it (between .20 and .30 per cent) that has been found essential by scientific tests to afford the greatest resistance to rust. Tests made by the American Society for Testing Materials, conducted over a series of years, demonstrated that the Beth-Cu-Loy copper-bearing steel that goes into these sheets has from 2 to 3 times the rust resistance of ordinary steel.

Beth-Cu-Loy copper-bearing sheets fabricated for roofing purposes are furnished either black, galvanized or painted. Beth-Cu-Loy Corrugated roofing is made in sections of from 5- to 12-feet in length and in standard gauges with 1¼-inch, 2-inch, 2½-inch and 3-inch corrugations. V-Crimped sheets for roofing are supplied in 2, 3 and 5 crimps, gauges from 20 to 29 inclusive and likewise in 5- to 12-foot lengths. Bethlehem Stormproof Roofing, a newly developed design, easy to lay and of a special side lap construction that affords great rigidity and effectively checks seepage from capillary attraction, is provided in similar lengths and in gauges 26, 28, and 29. Galvanized Beth-Cu-Loy Roll Roofing which is especially desirable for roofs with a low pitch is provided in rolls containing 50 linear feet and in gauges 24 to 29 inclusive.



Roll Roofing

Bethlehem Galvanized Non-Leak Roofing Nails are the most economical to use for fastening corrugated metal roofing. When driven down the curved head fits snugly on the ridge of the

corrugation thereby making a moisture-proof seal and dispensing with the need of washers or lead heads. A nub that extends above the curved head prevents damage to the head when the nail is driven. These nails are galvanized by the hot process, insuring protection against rust and service for as long as the life of the roofing itself.

WROUGHT STEEL PIPE

AT the Bethlehem Steel Company's plant at Sparrows Point, Md., wrought steel pipe is manufactured in sizes ranging from $\frac{1}{8}$ inch to 16 inches in diameter. Pipe of standard weight suited to all purposes for which pipe is employed on the farm is supplied in either black or galvanized finish. Extra Strong and Double Extra Strong pipe is also made in both of these finishes. The name, "Bethlehem," rolled into the skelp on Butt-weld pipe, or rolled into the pipe during the welding operation on Lap-weld pipe, carries the same implication of dependability in working qualities and serviceability in steel pipe that Bethlehem manufacture does in other steel and iron products.

BOLTS AND NUTS

BOLTS and nuts have been made at the Lebanon Plant of the Bethlehem Steel Company since 1865. The enormous consumption of bolts and nuts on American farms has from the first supplied an important outlet for the product of this plant which has at present capacity for producing 3,000,000 bolts, nuts and rivets each day. Bethlehem makes all the types and sizes of bolts and nuts that are in common use on the farm as well as a great variety of similar products such as washers, turnbuckles, clevises, rods, heavy spikes, hook bolts, wedges and bands for wooden pipes and tanks. Standard square-head machine bolts are provided in lengths from $\frac{3}{4}$ inch to 30 inches and ranging in diameter from 3/16 inch to 2 inches. Standard round-head carriage bolts range in diameter from 3/16 inch to $\frac{3}{4}$ inch, and in length from 1 to 20 inches. Lag bolts are also made in all standard sizes.

STEEL FOR FIRE-SAFE FARM STRUCTURES

DUE to its many advantages, steel construction for residences and other moderate-sized structures is creating widespread interest throughout the country. A frame of steel for your home or barn gives it much of the rigidity and permanence you have always associated with skyscrapers and similar large buildings. And of course steel serves as the basis for a high degree of fire-safety.

This should be of particular interest and importance to you in the country where fire-protection is generally more or less inadequate. Even if you use steel only in building the first floor of your home, you gain

Laying a fire-safe floor

a major degree of fire-protection. Insurance statistics show that the largest proportion of residential fires start in the basement. A floor built of either solid or open-web steel joists in combination with a plaster basement ceiling and a solid floor slab, has a fire-resistance rating of more than two hours and will confine fire to its point of origin for that period of time. The cost of this type of floor construction is relatively little more than if ordinary materials were used and the difference is often more than compensated by a reduction in fire-insurance premiums. Steel-joist-concrete floor construction is being widely used in building consolidated district schools.

Bethlehem has developed a complete line of light steel building members. Their use creates no new problems and presents no difficulties. Any progressive architect near you can supply you with detailed information on the use of steel in building fire-safe farm structures. Or, if you prefer, you may write direct to Bethlehem Steel Company, Bethlehem, Pa., for further advice on this modern way of incorporating greater permanence and safety in your home or other farm buildings.

A typical small home with a fire-safe floor of Bethlehem Open-Web Steel Joists and a concrete floor slab.

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